

## Selecting Appropriate Building Energy Simulation Software

### What building energy simulation software is appropriate for use with the Energy Cost Budget method in ASHRAE Standard 90.1 or the Total Building Performance section of the IECC?

Both methods list specific requirements for simulation programs. For the Energy Cost Budget (ECB) method, the requirements are found in Section 11.2.1 of ANSI/ASHRAE/IESNA Standard 90.1-2004 (and 90.1-2001 and 90.1-1999 as well). It states that the simulation program shall be "a computer-based program for the analysis of energy consumption in buildings. The simulation program shall include calculation methodologies for the building components being modeled. The simulation program shall be approved by the adopting authority and shall at a minimum have the ability to explicitly model all of the following:

1. A minimum of 1400 hours per year
2. Hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation, defined separately for each day of the week and holidays
3. Thermal mass effects
4. Ten or more thermal zones
5. Part-load performance curves for mechanical equipment
6. Capacity and efficiency correction curves for mechanical heating and cooling equipment
7. Air-side and water-side economizers with integrated control

In addition, the simulation program shall have the ability to either directly determine the design energy cost and energy cost budget *OR* produce hourly reports of energy use by energy source suitable for determining the design energy cost and energy cost budget using a separate calculation engine. The simulation program shall also be capable of performing design load calculations to determine required HVAC equipment capacities and air and water flow rates. The simulation program shall also be tested according to ASHRAE Standard 140 and the results shall be furnished by the software provider."

For the Total Building Performance (TBP) method in the International Code Council's International Energy Conservation Code (IECC), the appropriate reference is Section 506 of the 2006 IECC (also found in Section 806 of the 2003 or 2000 IECC). Section 506 does not go into as much detail as the ECB method, but the requirements are similar. The TBP method requires the use of an approved energy simulation tool. Climate data, energy costs, and building operation for 8,760 hours are required. Part-load performance and capacity curves are also referenced. There is also mention of HVAC system design capacity. The TBP method does have more specific documentation requirements than the ECB method, requiring annual energy use and associated costs, a list of energy-related features, input and output report(s), and a written explanation of any error or warning messages.

Some well known tools that meet these requirements include DOE's EnergyPlus software, DOE-2 (with many variants such as PowerDOE and Equest), BLAST, Trane Trace and Carrier HAP. There are numerous other programs that may also be used. Visit the [Building Energy Software Tools Directory](http://resourcecenter.pnl.gov/cocoon/morf/ResourceCenter) for an extensive directory of energy software tools maintained by DOE.

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